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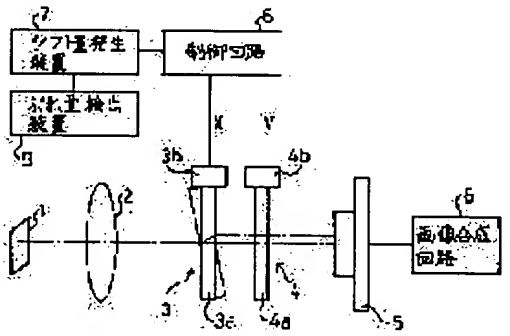
(54) IMAGE PICKUP DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To correct a blurring amount of a device and to obtain a high resolution image.

SOLUTION: An object image which is made incident through an optical system 2 is two-dimensionally shifted to a solid-state image pickup device 5 by an X axis image shift feature 3 and a Y axis image shift feature 4. A plurality of images which are shifted in this manner are synthesized by an image synthesizing circuit 6. At this point, a shift amount generator 7 generates a correction image shift amount, based on the blurring amount of a device and an image shift amount which are detected by a blurring amount detector 9. Then, the features 3 and 4 shift the object image, based on the image shift amount. Thereby, even if blurring is caused on the object image, e.g. when an image pickup device is held in hands, etc., image shift in consideration of the blurring amount is performed and a high resolution image can be acquired without being affected by such blurring.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to image pick-up equipment equipped with the image shift device for obtaining the image of high resolution especially about the image pick-up equipment which used the solid state image pickup device.
[0002]
[Description of the Prior Art] From the former, solid state image pickup devices, such as CCD (Charge Coupled Device), are widely used as an image sensor of a picture input device. The resolution of this solid state image pickup device is mostly determined by the number of pixels generally formed in the light-receiving side of the above-mentioned solid state image pickup device. Therefore, what is necessary is just to make the number of pixels of the above-mentioned solid state image pickup device increase fundamentally, in order to obtain high resolution. However, there was a limitation in making the number of pixels increase actually in respect of cost or size with the present technique.
[0003] It is indicated by JP,60-54576,A and JP,63-284980,A there about the image pick-up equipment which adopted the image shift device. Thereby, an image with comparatively high resolution is obtained using the solid state image pickup device of the limited number of pixels.
[0004] Only the minute distance delta shifts the incident light from a photographic subject, and he carries out incidence to a solid state image pickup device, and is trying to capture each image to an image memory by changing the tilt angle theta of parallel plate glass 101 with the image pick-up equipment of the above-mentioned former, as shown in drawing 16 . Incidentally, the relation between n, then the tilt angle theta of parallel plate glass 101 and shift-amount delta is delta=t-sintheta (1-1/n) about t and a refractive index in the thickness of parallel plate glass 101.
It comes out.
[0005] He makes the light-receiving side of a solid state image pickup device 203 carry out incidence of the light from a photographic subject 200 through optical system 201 and parallel plate glass 202a, and is trying to capture each image to the image memory of the image formation section 204 with the image pick-up equipment of the above-mentioned latter, on the other hand, as shown in drawing 17 . In addition, the above-mentioned parallel plate glass 202a is being fixed to driving gear 202b, and, only in a predetermined include angle, the above-mentioned parallel plate glass 202a inclines to an optical axis by this driving gear 202b.
[0006] He compounds two or more images which carried out in this way and were captured to the image memory, and is trying to obtain high resolution in the above-mentioned conventional technique on the case where the number of pixels of a solid state image pickup device is made to increase, and an equivalence target.
[0007] Next, the actuation which compounds the images A and B of two sheets by which the image shift was carried out on an image memory is explained based on drawing 17 thru/or drawing 20 . In addition, since the image composition actuation in above-mentioned both conventional technique is fundamentally the same, on [of explanation] expedient and here explain using the conventional

technique of the above-mentioned latter.
[0008] First, the image A of the 1st sheet is memorized on the image memory of the image formation section 204. Drawing 18 (a) shows arrangement of the image data at this time. In addition, it is shown that "A" in this drawing is the image data of Image A, and the suffix character shows the matrix number of each image data. It is got blocked, for example, it is shown that A12 is the image data of eye one-line trains [two trains] in Image A.
[0009] Next, 45 degrees parallel plate glass 202a is horizontally leaned to 45 degrees and a perpendicular direction to the pixel array of a solid state image pickup device 203, the image shift of the photographic subject image on a solid state image pickup device 203 is carried out, and the image B of the 2nd sheet is obtained. And this image B is memorized on the image memory of the image formation section 204. Drawing 18 (b) shows arrangement of the image data at this time. In addition, it is shown that "B" in this drawing is the image data of Image B, and the suffix character shows the matrix number of each image data. It is got blocked, for example, it is shown that B12 is the image data of eye one-line trains [two trains] in Image B.
[0010] Here, the physical relationship of the image data of the images A and B of the two above-mentioned sheets comes to be shown in drawing 19 . A broken line shows the image data of the image A of the 1st sheet among this drawing, and the continuous line shows the image data of the image B of the 2nd sheet. That is, the image data of Image B serves as arrangement shifted to the image data of Image A only one half of the pixel pitches Px and Py of X shaft orientations of a solid state image pickup device 203, and Y shaft orientations. In addition, the horizontal direction of a solid state image pickup device 203 is made into X shaft orientations, and it is perpendicularly made into Y shaft orientations here.
[0011] And the image formation section 204 compounds the image data of the images A and B of two sheets, as shown in drawing 20 . Although the location shown by "O" among drawing is a null at first at this time, the new image data obtained by interpolating computing the average value from a surrounding pixel, for example etc. will be applied to this location. The resolution of the synthetic image obtained as mentioned above becomes twice [about] the resolution obtained in a solid state image pickup device 203 at the beginning.
[0012]
[Problem(s) to be Solved by the Invention] Thus, when obtaining the image of high resolution in the image pick-up equipment which carried the image shift device, it is necessary to input at least the image of two sheets which was far apart in time as mentioned above for an image shift. At this time, the gap by the time factor in addition to an image shift arises actually in the images A and B of the two above-mentioned sheets by which the image shift was carried out. It is thought that this gap is produced by the unstable oscillation (blurring is called hereafter) produced when the stock of the image pick-up equipment is carried out, migration of a photographic subject 200, etc. In addition, since the latter is a problem not only common to the image pick-up equipment which carried the image shift device but all image pick-up equipments, it does not make reference here.
[0013] Therefore, with the above-mentioned conventional configuration, when a stock is carried out without fixing image pick-up equipments, such as a still camera and a movie, to a tripod etc., even if gaps other than an image shift arise in the images A and B of two sheets by blurring, consequently it performs an image shift, the problem that an image with high resolution cannot be obtained arises. Moreover, if such a gap is large, the problem that it will be difficult to aim at improvement in the resolution of the image after composition itself, and resolution will deteriorate depending on the case will arise.
[0014] It was made in order that this invention might solve the above-mentioned trouble, and the object is in offering the image pick-up equipment which can prevent degradation of the resolution produced by blurring.
[0015]
[Means for Solving the Problem] In order that the image pick-up equipment concerning invention of claim 1 may solve the above-mentioned technical problem, the photographic subject image which

carries out incidence through optical system The image shift device in which are image pick-up equipment picturized with the solid state image pickup device which has two or more pixels arranged in the shape of a matrix, and the relative shift of the above-mentioned photographic subject image is carried out two-dimensional to the above-mentioned solid state image pickup device, A shift-amount generating means to generate the image shift amount of the above-mentioned photographic subject image, The control means which controls actuation of the above-mentioned image shift device, and an image composition means to compound two or more images shifted by the above-mentioned image shift device, An amount detection means of blurring to detect the amount of blurring of equipment is established. The above-mentioned shift-amount generating means The 1st amendment image shift amount is generated based on the above-mentioned image shift amount and the above-mentioned amount of blurring, and it is characterized by the above-mentioned image shift device shifting a photographic subject image based on the above-mentioned 1st amendment image shift amount.

[0016] According to the above-mentioned configuration, a relative shift is carried out by the image shift device two-dimensional to a solid state image pickup device, and the photographic subject image which carries out incidence through optical system is picturized with the above-mentioned solid state image pickup device. And two or more images shifted in this way will be compounded by the image composition means. At this time, the image shift amount of a photographic subject image is generated by the shift-amount generating means. Moreover, actuation of the above-mentioned image shift device is controlled by the control means.

[0017] Even if blurring arises in a photographic subject image when the stock of the image pick-up equipment is carried out, for example since a shift-amount generating means generates the 1st amendment image shift amount based on the above-mentioned image shift amount and the above-mentioned amount of blurring and the above-mentioned image shift device shifts a photographic subject image based on the above-mentioned 1st amendment image shift amount at this time, the image shift which took into consideration also in that amount of blurring will be performed. Therefore, according to the above-mentioned configuration, even if blurring arises to equipment by a stock etc., the image of high resolution which is not influenced by such blurring can be obtained.

[0018] The image pick-up equipment concerning invention of claim 2 is set in the configuration of claim 1, in order to solve the above-mentioned technical problem. The above-mentioned shift-amount generating means A predetermined operation divides the above-mentioned 1st amendment image shift amount into the 2nd amendment image shift amount and the amount of amendments. While the above-mentioned image shift device shifts a photographic subject image based on the above-mentioned 2nd amendment image shift amount, it is characterized by the above-mentioned image composition means performing an image processing based on the above-mentioned amount of amendments.

[0019] According to the above-mentioned configuration, the above-mentioned 1st amendment image shift amount is divided into the 2nd amendment image shift amount and the amount of amendments by the predetermined operation of a shift-amount generating means. The above-mentioned image shift device makes a photographic subject image shifted based on the small above-mentioned 2nd amendment image shift amount of a shift amount rather than the above-mentioned 1st amendment image shift amount at this time. A response becomes fully possible also by the small image shift device by this, and the image shift itself is performed promptly. Therefore, according to the above-mentioned configuration, while being able to attain the miniaturization of an image shift device, improvement in the speed of an image shift can be attained.

[0020] In order that the image pick-up equipment concerning invention of claim 3 may solve the above-mentioned technical problem, in the configuration of claim 2, the above-mentioned 2nd amendment image shift amount is the fraction part of the above-mentioned 1st amendment image shift amount, and the above-mentioned amount of amendments is characterized by being the integer part of the above-mentioned 1st amendment image shift amount.

[0021] According to the above-mentioned configuration, the above-mentioned image shift device makes a photographic subject image shifted based on the 2nd amendment image shift amount which is the fraction part of the above-mentioned 1st amendment image shift amount. Since the range of an image

shift becomes narrower than the beginning by this, a response becomes fully possible also by the small image shift device, and the image shift itself is performed promptly. Therefore, according to the above-mentioned configuration, while being able to attain the miniaturization of an image shift device, improvement in the speed of an image shift can be attained.

[0022] In order that the image pick-up equipment concerning invention of claim 4 may solve the above-mentioned technical problem, the above-mentioned 2nd amendment image shift amount is a difference with the amount which revalued the fraction part of the above-mentioned 1st amendment image shift amount and the above-mentioned 1st amendment image shift amount, and the above-mentioned amount of amendments is carrying out that it is the amount revalued in the fraction part of the above-mentioned 1st amendment image shift amount as the description in the configuration of claim 2.

[0023] According to the above-mentioned configuration, the above-mentioned image shift device makes a photographic subject image shifted based on the 2nd amendment image shift amount which is the difference of the above-mentioned 1st amendment image shift amount and the amount which revalued the fraction part of the above-mentioned 1st amendment image shift amount. Since the range of an image shift becomes narrower than the beginning by this, a response becomes fully possible also by the small image shift device, and the image shift itself is performed promptly. Therefore, according to the above-mentioned configuration, while being able to attain the miniaturization of an image shift device, improvement in the speed of an image shift can be attained.

[0024] In order that the image pick-up equipment concerning invention of claim 5 may solve the above-mentioned technical problem, the above-mentioned 2nd amendment image shift amount is a difference with the integer part of an amount which added 0.5 to the above-mentioned 1st amendment image shift amount and the above-mentioned 1st amendment image shift amount, and it is carrying out that the above-mentioned amount of amendments is the integer part of the amount added in 0.5 to the above-mentioned 1st amendment image shift amount as the description in the configuration of claim 2.

[0025] According to the above-mentioned configuration, the above-mentioned image shift device makes a photographic subject image shifted to the above-mentioned 1st amendment image shift amount and the above-mentioned 1st amendment image shift amount based on the 2nd amendment image shift amount which is a difference with the integer part adding 0.5 of an amount. Since the range of an image shift becomes narrower than the beginning by this, a response becomes fully possible also by the small image shift device, and the image shift itself is performed promptly.

[0026] Moreover, since the amount which carries out an image shift according to the above-mentioned image shift device, i.e., the 2nd amendment image shift amount, becomes below a **0.5-pixel pitch according to the above-mentioned configuration, there is little absolute magnitude of the variation rate by image shift, and it comes to end. Therefore, according to the above-mentioned configuration, while being able to attain the further miniaturization of an image shift device, further improvement in the speed of an image shift can be attained.

[0027] In order that the image pick-up equipment concerning invention of claim 6 may solve the above-mentioned technical problem, the photographic subject image which carries out incidence through optical system The image shift device in which are image pick-up equipment picturized with the solid state image pickup device which has two or more pixels arranged in the shape of a matrix, and only a predetermined shift amount carries out the relative shift of the above-mentioned photographic subject image two-dimensional to the above-mentioned solid state image pickup device, The control means which controls actuation of the above-mentioned image shift device, and an amount detection means of blurring to detect the amount of blurring of equipment, A judgment means of operation to judge actuation of whether for the above-mentioned amount of blurring to be compared with a predetermined value, and to perform an image shift, When the above-mentioned judgment means of operation judges that it is larger than a value predetermined [above-mentioned] in the above-mentioned amount of blurring While carrying out interpolation processing of the image picturized with the above-mentioned solid state image pickup device and obtaining an image, when the above-mentioned judgment means of operation judges that it is below a value predetermined [above-mentioned] in the above-mentioned amount of blurring It is characterized by establishing an image composition means to compound two or

more images shifted by the above-mentioned image shift device by the image processing.
[0028] According to the above-mentioned configuration, based on the photographic subject image by which the judgment means of operation was picturized with the solid state image pickup device not through an image shift but through optical system when the amount of blurring which the amount detection means of blurring detects judged that it is larger than a predetermined value, interpolation processing is performed and an image is obtained by the image composition means.
[0029] To a solid state image pickup device, only a predetermined shift amount is shifted by the image shift device two-dimensional, and the photographic subject image in which a judgment means of operation carries out incidence through optical system on the other hand when the above-mentioned amount of blurring judges that it is below the above-mentioned predetermined value is picturized with the above-mentioned solid state image pickup device. And two or more photographic subject images picturized with the above-mentioned solid state image pickup device are compounded by the image processing of an image composition means. At this time, actuation of the above-mentioned image shift device is controlled by the control means.
[0030] That is, according to the above-mentioned configuration, actuation of an image composition means will be properly used with extent of the above-mentioned amount of blurring. Therefore, according to the above-mentioned configuration, according to the above-mentioned amount of blurring, a high resolution image can be obtained by choosing the optimal image-processing method according to the above-mentioned amount of blurring.
[0031] In order that the image pick-up equipment concerning invention of claim 7 may solve the above-mentioned technical problem, the photographic subject image in which a focal distance carries out incidence through the optical system which is adjustable The image shift device in which are image pick-up equipment picturized with the solid state image pickup device which has two or more pixels arranged in the shape of a matrix, and only a predetermined shift amount carries out the relative shift of the above-mentioned photographic subject image two-dimensional to the above-mentioned solid state image pickup device, The control means which controls actuation of the above-mentioned image shift device, and a focal distance detection means to detect the focal distance of the above-mentioned optical system, A judgment means of operation to judge actuation of whether for the above-mentioned focal distance to be compared with a predetermined value, and to perform an image shift, When the above-mentioned judgment means of operation judges that it is larger than a value predetermined [above-mentioned] in the above-mentioned focal distance While carrying out interpolation processing of the image picturized with the above-mentioned solid state image pickup device and obtaining an image, when the above-mentioned judgment means of operation judges that it is below a value predetermined [above-mentioned] in the above-mentioned focal distance It is characterized by establishing an image composition means to compound two or more images shifted by the above-mentioned image shift device by the image processing.
[0032] According to the above-mentioned configuration, based on the photographic subject image by which the judgment means of operation was picturized with the solid state image pickup device not through an image shift but through optical system when the focal distance which a focal distance detection means detects judged that it is larger than a predetermined value, interpolation processing is performed and an image is obtained by the image composition means.
[0033] To a solid state image pickup device, only a predetermined shift amount is shifted by the image shift device two-dimensional, and the photographic subject image in which a judgment means of operation carries out incidence through optical system on the other hand when the above-mentioned focal distance judges that it is below the above-mentioned predetermined value is picturized with the above-mentioned solid state image pickup device. And two or more photographic subject images picturized with the above-mentioned solid state image pickup device are compounded by the image processing of an image composition means. At this time, actuation of the above-mentioned image shift device is controlled by the control means.
[0034] That is, according to the above-mentioned configuration, actuation of an image composition means will be properly used with the magnitude of the above-mentioned focal distance. Therefore,

according to the above-mentioned configuration, according to extent of the above-mentioned focal distance, a high resolution image can be obtained by choosing the optimal image-processing method according to extent of the above-mentioned focal distance.

[0035]

[Embodiment of the Invention]

[Gestalt 1 of operation] It will be as follows if one gestalt of operation of this invention is explained based on drawing 1 thru/or drawing 4 .

[0036] Drawing 1 shows the configuration of the outline of the image pick-up equipment in this operation gestalt. This image pick-up equipment is equipped with optical system 2, the X-axis image shift device 3, the Y-axis image shift device 4, a solid state image pickup device 5, the image composition circuit 6, the shift-amount generator 7, a control circuit 8, and the amount detection equipment 9 of blurring. In addition, the alternate long and short dash line in this drawing shows the optical axis. In addition, this invention is not restricted, although a graphic display and its explanation are directly omitted about the members (for example, image processing system for acquiring the actuation circuit of a solid state image pickup device 5, and a video signal etc.) of others irrelevant to this invention in order to simplify explanation.

[0037] Optical system 2 is constituted including the lens group for completing the incident light from a photographic subject 1 on a solid state image pickup device 5 etc.

[0038] To the solid state image pickup device 5, the light from the photographic subject image which penetrates parallel plate 3a with the transparent X-axis image shift device 3 and this parallel plate 3a consists of driving gear 3b to which only a predetermined include angle leans the above-mentioned parallel plate 3a horizontally to an optical axis so that only a predetermined shift amount may carry out a relative shift horizontally. In addition, the amount of inclinations of parallel plate 3a is controlled by the control circuit 8.

[0039] To the solid state image pickup device 5, the light from the photographic subject image which penetrates parallel plate 4a with the transparent Y-axis image shift device 4 and this parallel plate 4a consists of driving gear 4b to which only a predetermined include angle leans the above-mentioned parallel plate 4a perpendicularly to an optical axis so that only a predetermined shift amount may carry out a relative shift perpendicularly. In addition, the amount of inclinations of parallel plate 4a is controlled by the control circuit 8.

[0040] That is, the X-axis image shift device 3 manages independently the horizontal image shift of a solid state image pickup device 5, and the Y-axis image shift device 4 manages independently the image shift of the perpendicular direction of a solid state image pickup device 5. In addition, since the detailed configuration of the X-axis image shift device 3 and the Y-axis image shift device 4 is explained to Japanese Patent Application No. No. 8628 [eight to] proposed by the same applicant as this application in detail, it omits the detailed explanation here.

[0041] The solid state image pickup device 5 consists of CCD (Charge Coupled Device) arranged in the shape of a matrix. By this, two or more pixels will be arranged two-dimensional in the light-receiving side of a solid state image pickup device 5. Consequently, only a predetermined shift amount is shifted by the X-axis image shift device 3 and the Y-axis image shift device 4 two-dimensional, and the image of the photographic subject 1 condensed by optical system 2 is picturized with a solid state image pickup device 5. Moreover, the image composition circuit 6 as an image composition means is shifted by the X-axis image shift device 3 and the Y-axis image shift device 4, and has the function which compounds two or more images picturized with the solid state image pickup device 5.

[0042] The shift-amount generator 7 as a shift-amount generating means generates the image shift amount (Xr, Yr) of the photographic subject image used as the controlled-system value of a control circuit 8 (control means). In addition, above Xr and Yr shall express the image shift amount of horizontal [of the above-mentioned photographic subject image], and a perpendicular direction, respectively. And a control circuit 8 controls actuation of the X-axis image shift device 3 and the Y-axis image shift device 4 so that the image of a photographic subject 1 shifts only this image shift amount (Xr, Yr).

[0043] In the usual case, this image shift amount (Xr, Yr) is being fixed so that it may be set to Xr=1/2Px and Yr=1/2Py. In addition, Px and Py show the pixel pitch of X shaft orientations (horizontal direction) of a solid state image pickup device 5, and Y shaft orientations (perpendicular direction), respectively.
[0044] The amount detection equipment 9 of blurring as an amount detection means of blurring is equipment for detecting the amounts of blurring, such as an oscillation produced when the stock of the image pick-up equipment is carried out. If it blurs with the amount detection equipment 9 of blurring and an amount is detected, based on the above-mentioned image shift amount (Xr, Yr) and the above-mentioned amount of blurring, the shift-amount generator 7 will calculate a new amendment image shift amount (X, Y), will be generated, and will be outputted to a control circuit 8. In addition, the above-mentioned amendment image shift amount (X, Y) is equivalent to the 1st amendment image shift amount according to claim 1.
[0045] Next, it will be as follows if actuation of the image pick-up equipment in this operation gestalt is explained.
[0046] Drawing 2 (a) shows the shift position of the photographic subject image by image shift, and drawing 2 (b) shows the timing of the image incorporation in a solid state image pickup device 5.
[0047] First, a control circuit 8 carries out actuation control of the driving gears 3b and 4b according to the output value (for example, Xr=0, Yr=0) which the shift-amount generator 7 generates. Then, the photographic subject image which penetrated optical system 2, the X-axis image shift device 3, and the Y-axis image shift device 4, respectively is picturized on a solid state image pickup device 5 in the location of A shown in this drawing (a), and tia period maintenance is carried out there. And the above-mentioned photographic subject image is accumulated in the photo detector section on a solid state image pickup device 5 (not shown) to the timing of ta shown in this drawing (b). Then, reading appearance of the image data of the above-mentioned photographic subject image is carried out to the image memory of the image composition circuit 6 over the time amount of dt. In addition, the 1st image data by which did in this way and reading appearance was carried out to the image memory is called image data A below. It seems that this image data A is shown in drawing 18 (a).
[0048] Next, according to the output value (for example, Xr=1/2Px, Yr=1/2Py) which the shift-amount generator 7 generates, actuation control of the driving gears 3b and 4b is carried out, and, as for a control circuit 8, only a predetermined include angle leans the parallel plates 3a and 4a to an optical axis. Then, a photographic subject image is shifted to the location of B shown in this drawing (a), and is picturized on a solid state image pickup device 5, and tib period maintenance is carried out there. And the above-mentioned photographic subject image is accumulated in the photo detector section on a solid state image pickup device 5 to the timing of tb shown in this drawing (b). Then, reading appearance of the image data of the above-mentioned photographic subject image is carried out to the image memory of the image composition circuit 6 over the time amount of dt. In addition, the 2nd image data by which did in this way and reading appearance was carried out to the image memory is called image data B below. It seems that this image data B is shown in drawing 18 (b).
[0049] That is, after the 1st image is formed in the photo detector section of a solid state image pickup device 5 before the 2nd image is formed, the time difference of dt will arise. In this case, if the transit time (transition time) tab from A location in the said drawing to B location of a photographic subject image excels, naturally dt will receive constraint in transit time tab. That is, dt is limited.
[0050] Therefore, if image pick-up equipment vibrates by blurring etc., as shown in drawing 3 , blurring will arise in a photography image (in the case of this operation gestalt alphabetic character of "A"). That is, in drawing 3 , the photographic subject image has blurred in the condition which showed by white coating from the condition shown with the slash between dt time amount. At this time, the amount of blurring of dx and Y shaft orientations (perpendicular direction) is set to dy for the amount of blurring of X shaft orientations (horizontal).
[0051] Therefore, an amendment image shift amount (X, Y) is briefly expressed like the following formulas at the beginning using the image shift amount (Xr (for example, 1/2Px), Yr (for example, 1/2Py)) and the above-mentioned amount of blurring (dx, dy) of a schedule. In addition, let the unit of

an amendment image shift amount (X, Y) be each pixel pitch of horizontal [of a solid state image pickup device 5], and a perpendicular direction.
[0052] If X=Xr+dxY=Yr+dy, therefore the amount detection equipment 9 of blurring blur and an amount (dx, dy) is detected, the shift-amount generator 7 will perform the above-mentioned operation, will generate a new amendment image shift amount (X, Y), and will output to a control circuit 8. Here, arrangement of the image data A and B in consideration of the amount of blurring (dx, dy) of the image of two sheets is shown in drawing 4 . And this image data A and B is compounded by the image shift same in the image composition circuit 6 as usual.
[0053] According to the above-mentioned configuration, the shift-amount generator 7 calculates an amendment image shift amount based on the original image shift amount (Xr, Yr) and the amount of blurring of the equipment which the amount detection equipment 9 of blurring detected (dx, dy), and the X-axis image shift device 3 and the Y-axis image shift device 4 are performing the image shift of a photographic subject image based on the above-mentioned amendment image shift amount, respectively. When the stock for example, of the image pick-up equipment is carried out, even if blurring arises in a photographic subject image by this, the image shift in consideration of the amount of blurring will be performed. Therefore, according to the above-mentioned configuration, even if blurring arises to equipment by a stock etc., the image of high resolution which is not influenced by such blurring can be obtained.
[0054] [Gestalt 2 of operation] It will be as follows if other one gestalt of operation of this invention is explained based on drawing 5 thru/or drawing 7 . In addition, since the overall configuration of the image pick-up equipment in this operation gestalt is completely the same as that of the gestalt 1 of operation, the explanation is omitted. Moreover, with this operation gestalt, since it is completely the same as that of the gestalt 1 of operation except actuation of the image composition circuit 6 and the shift-amount generator 7 (both refer to drawing 1), actuation of the image composition circuit 6 and the shift-amount generator 7 is mainly explained.
[0055] Drawing 5 is a flow chart which shows the flow of the actuation in the shift-amount generator 7 of this operation gestalt. First, if the amount detection equipment 9 (refer to drawing 1) of blurring blurs and an amount (dx, dy) is detected (a step is only written as S below step 1;), the shift-amount generator 7 will calculate an amendment image shift amount (X, Y) with the same operation expression as the gestalt 1 of operation (S2).
[0056] Next, the shift-amount generator 7 performs the following operations, and obtains a new amendment image shift amount (X', Y') (S3). In addition, the above-mentioned amendment image shift amount (X', Y') is equivalent to the 2nd amendment image shift amount according to claim 2.
[0057] X'=X-int (X)
Y'=Y-int (Y)
However, int (a) shall express the integer of the negative side nearest to a.
[0058] And the shift-amount generator 7 outputs the above-mentioned amendment image shift amount (X', Y') to a control circuit 8 (refer to drawing 1) (S4).
[0059] On the other hand, the image composition circuit 6 (refer to drawing 1) amends image data on an image memory according to the amount of amendments (Xint, Yint) shown below. In addition, when the amount of amendments (Xint, Yint) is forward, image data A is amended, and when the amount of amendments (Xint, Yint) is negative, image data B is amended.
[0060] Xint=int(X)
Yint=int(Y)
That is, while the shift-amount generator 7 outputs the decimal part of an amendment image shift amount (X, Y) to a control circuit 8 and the image shift of the photographic subject image is carried out, the image composition circuit 6 will perform amendment corresponding to the amount of the integral part of an amendment image shift amount (X, Y) by the image processing.
[0061] Here, arrangement of image data A in the image memory of the image composition circuit 6 in the case of being Xint=1 and Yint=1 is shown to drawing 6 (a) and drawing 6 (b). In addition, drawing 6 (a) shows arrangement of image data A before amendment, and drawing 6 (b) shows arrangement of

image data A after amendment. In addition, the suffix character attached all over this drawing shall show the matrix number of each image data. For example, it is shown that A12 is data of eye one-line trains [two trains] in image data A.

[0062] When it amends as mentioned above, it is arranged after image data's A's22 amending in the location of the image data A11 before amendment. Moreover, it is arranged after image data's A's23 amending in the location of the image data A12 before amendment. That is, the image data after amendment will be arranged in the location where Xint and Yint were added to each suffix character of the image data before amendment.

[0063] Thus, the result of having compounded amended image data A and image data B is shown in drawing 7 . As shown in this drawing, it becomes what lacked image data A11 and A12 grade in this case. However, if compared with the total number of pixels of a synthetic image, since the lacked amounts are few, the effect on an image is slight.

[0064] According to the above-mentioned configuration, the above-mentioned amendment image shift amount (X, Y) is divided into an amendment image shift amount (X', Y') and the amount of amendments (Xint, Yint) by the predetermined operation of the shift-amount generator 7. In the case of this operation gestalt, the amendment image shift amount (X', Y') has become under the decimal part of an amendment image shift amount (X, Y), i.e., a 1-pixel pitch. And the X-axis image shift device 3 and the Y-axis image shift device 4 make a photographic subject image shifted based on an amendment image shift amount (X', Y'), respectively. Since the range of an image shift becomes narrower than the beginning by this, even if the X-axis image shift device 3 and the Y-axis image shift device 4 are small, a response becomes fully possible, and the image shift itself is performed promptly. Therefore, according to the above-mentioned configuration, while being able to attain the miniaturization of the X-axis image shift device 3 and the Y-axis image shift device 4, improvement in the speed of an image shift can be attained.

[0065] In addition, what is necessary is just to amend image data B as mentioned above, even when Xint and Yint are negative.

[0066] [Gestalt 3 of operation] It will be as follows if other one gestalt of operation of this invention is explained based on drawing 8 . In addition, since the overall configuration of the image pick-up equipment in this operation gestalt is completely the same as that of the gestalt 1 of operation, the explanation is omitted. Moreover, with this operation gestalt, since it is completely the same as that of the gestalt 1 of operation except actuation of the image composition circuit 6 and the shift-amount generator 7 (both refer to drawing 1), actuation of the image composition circuit 6 and the shift-amount generator 7 is mainly explained.

[0067] Drawing 8 is a flow chart which shows the flow of the actuation in the shift-amount generator 7 of this operation gestalt. First, if the amount detection equipment 9 (refer to drawing 1) of blurring blurs and an amount (dx, dy) is detected (S11), the shift-amount generator 7 will calculate an amendment image shift amount (X, Y) with the same operation expression as the gestalt 1 of operation (S12).

[0068] Next, the shift-amount generator 7 performs the following operations, and obtains a new amendment image shift amount (X', Y') (S13). In addition, this amendment image shift amount (X', Y') is equivalent to the 2nd amendment image shift amount according to claim 2.

[0069] X'=X-fro (X)
Y'=Y-fro (Y)
However, fro (a) shall express the integer by the side of forward [nearest to a].

[0070] And the shift-amount generator 7 outputs the above-mentioned amendment image shift amount (X', Y') to a control circuit 8 (refer to drawing 1) (S14).

[0071] On the other hand, the image composition circuit 6 (refer to drawing 1) amends image data on an image memory according to the amount of amendments (Xfro, Yfro) shown below. In addition, when the amount of amendments (Xfro, Yfro) is forward, image data A is amended, and when the amount of amendments (Xfro, Yfro) is negative, image data B is amended.

[0072] Xfro=fro(X)
Yfro=fro(Y)

That is, the shift-amount generator 7 outputs the amendment image shift amount (X', Y') which is the difference of the above-mentioned amendment image shift amount (X, Y) and the amount which revalued the fraction part of the above-mentioned amendment image shift amount (X, Y) to a control circuit 8. Of course at this time, an amendment image shift amount (X', Y') serves as a value of under a 1-pixel pitch smaller than an amendment image shift amount (X, Y). And the X-axis image shift device 3 and the Y-axis image shift device 4 carry out the image shift of the photographic subject image based on the above-mentioned amendment image shift amount (X', Y').

[0073] On the other hand, the image composition circuit 6 will perform amendment corresponding to the amount which revalued the fraction part of an amendment image shift amount (X, Y) by the image processing. In addition, since the amendment approach of image data is the same as that of the gestalt 2 of above-mentioned operation, the explanation is omitted. Therefore, since the range of the image shift also as above configurations becomes narrower than the beginning consequently, the same effectiveness as the gestalt 2 of operation can be acquired.

[0074] [Gestalt 4 of operation] It will be as follows if other one gestalt of operation of this invention is explained based on drawing 9 . In addition, since the overall configuration of the image pick-up equipment in this operation gestalt is completely the same as that of the gestalt 1 of operation, the explanation is omitted. Moreover, with this operation gestalt, since it is completely the same as that of the gestalt 1 of operation except actuation of the image composition circuit 6 and the shift-amount generator 7 (both refer to drawing 1), actuation of the image composition circuit 6 and the shift-amount generator 7 is mainly explained.

[0075] Drawing 9 is a flow chart which shows the flow of the actuation in the shift-amount generator 7 of this operation gestalt. First, if the amount detection equipment 9 (refer to drawing 1) of blurring blurs and an amount (dx, dy) is detected (S21), the shift-amount generator 7 will calculate an amendment image shift amount (X, Y) with the same operation expression as the gestalt 1 of operation (S22).

[0076] Next, the shift-amount generator 7 performs the following operations, and obtains a new amendment image shift amount (X', Y') (S23). In addition, this amendment image shift amount (X', Y') is equivalent to the 2nd amendment image shift amount according to claim 2.

[0077] X'=X-int (X+0.5)
Y'=Y-int (Y+0.5)
However, int (a) shall express the integer of the negative side nearest to a.

[0078] And the shift-amount generator 7 outputs the above-mentioned amendment image shift amount (X', Y') to a control circuit 8 (refer to drawing 1) (S24).

[0079] On the other hand, the image composition circuit 6 (refer to drawing 1) amends image data on an image memory according to the amount of amendments (Xint, Yint) shown below. In addition, when the amount of amendments (Xint, Yint) is forward, image data A is amended, and when the amount of amendments (Xint, Yint) is negative, image data B is amended.

[0080] Xint=int(X+0.5)
Yint=int(Y+0.5)
That is, the shift-amount generator 7 outputs the amendment image shift amount (X', Y') which is a difference with the integer part of an amount which added 0.5 to the above-mentioned amendment image shift amount (X, Y) and the above-mentioned amendment image shift amount (X, Y) to a control circuit 8. Of course at this time, an amendment image shift amount (X', Y') serves as a value of under a **0.5-pixel pitch smaller than an amendment image shift amount (X, Y). And the X-axis image shift device 3 and the Y-axis image shift device 4 carry out the image shift of the photographic subject image based on the above-mentioned amendment image shift amount (X', Y').

[0081] On the other hand, the image composition circuit 6 will perform amendment corresponding to the integer part of an amount which added 0.5 to the amendment image shift amount (X, Y) by the image processing. In addition, since the amendment approach of image data is the same as that of the gestalt 2 of above-mentioned operation, the explanation is omitted.

[0082] Therefore, the same effectiveness as the gestalt 2 of the operation also as above configurations can be acquired. Especially, since the amount which a photographic subject image shifts is below a

**0.5-pixel pitch in the case of this operation gestalt, the absolute magnitude of the variation rate by image shift decreases compared with the gestalten 1, 2, and 3 of operation. Thereby, while being able to miniaturize further the X-axis image shift device 3 and the Y-axis image shift device 4 (both refer to drawing 1), an image shift can be performed further at high speed.

[0083] [Gestalt 5 of operation] It will be as follows if other one gestalt of operation of this invention is explained based on drawing 10 thru/or drawing 13 . In addition, the member number same about the member of explanation used by the gestalt 1 of operation thru/or 4 and the member which has the same function is written in addition for convenience, and the explanation is omitted.

[0084] Drawing 10 shows the configuration of the outline of the image pick-up equipment in this operation gestalt. This image pick-up equipment is equipped with optical system 2, the X-axis image shift device 3 (image shift device), the Y-axis image shift device 4 (image shift device), a solid state image pickup device 5, the image composition circuit 6 (image composition means), the shift-amount generator 7, a control circuit 8 (control means), the amount detection equipment 9 (the amount detection means of blurring) of blurring, and the judgment circuit 10 (judgment means of operation) of operation. In addition, the alternate long and short dash line in this drawing shows the optical axis. In addition, this invention is not restricted, although a graphic display and its explanation are directly omitted about the members (for example, image processing system for acquiring the actuation circuit of a solid state image pickup device 5, and a video signal etc.) of others irrelevant to this invention in order to simplify explanation.

[0085] Moreover, with this operation gestalt, while the image composition circuit 6 is connected to the shift-amount generator 7, the amount detection equipment 9 of blurring is connected to the shift-amount generator 7 and the image composition circuit 6 through the judgment circuit 10 of operation. The judgment circuit 10 of operation judges actuation of whether for the amount of blurring which the amount detection equipment 9 of blurring detects to be compared with a predetermined value, and to perform an image shift, and has the function which controls actuation of the shift-amount generator 7 and the image composition circuit 6.

[0086] Moreover, when it judges that the image composition circuit 6 is larger than a value predetermined [circuit / 10 / above-mentioned / of operation / judgment / above-mentioned] in the above-mentioned amount of blurring, while carrying out interpolation processing in the image picturized with the above-mentioned solid state image pickup device 5 and obtaining an image, when the above-mentioned judgment circuit 10 of operation judges that it is below the above-mentioned predetermined value in the above-mentioned amount of blurring, two or more images by which the image shift was carried out compound by the image processing.

[0087] It will be as follows if here explains the detailed configuration of the amount detection equipment 9 of blurring in this operation gestalt based on drawing 11 .

[0088] As shown in drawing 11 , the amount detection equipment 9 of blurring has the X-axis angle-of-rotation acceleration sensor 21 which detects the angle-of-rotation acceleration of X shaft orientations of image pick-up equipment, and the Y-axis angle-of-rotation acceleration sensor 22 which detects the angle-of-rotation acceleration of Y shaft orientations of image pick-up equipment. In addition, the above-mentioned X-axis and Y shaft orientations mean the horizontal direction and the perpendicular direction to the pixel array of a solid state image pickup device 5, respectively.

[0089] The X-axis angle-of-rotation acceleration sensor 21 and the Y-axis angle-of-rotation acceleration sensor 22 are connected to integrators 23 and 24, respectively. Integrators 23 and 24 integrate with the output from the X-axis angle-of-rotation acceleration sensor 21 and the Y-axis angle-of-rotation acceleration sensor 22, respectively, and ask for the angular rate of rotation.

[0090] Moreover, focal distance detection equipment 25 is formed in this amount detection equipment 9 of blurring. Focal distance detection equipment 25 detects and outputs the focal distance of optical system 2. In addition, when optical system 2 is a fixed focus, focal distance detection equipment 25 does not detect a focal distance, for example, outputs constant value. Moreover, although focal distance detection equipment 25 may consist of potentionmeters interlocked with BARIETA for example, within optical system 2, or a compensator, it is not necessarily restricted to this and just detects the focal

distance of optical system 2 as a result.
[0091] The amount operation part 26 of blurring is connected to this focal distance detection equipment 25. The amount operation part 26 of blurring has the function to calculate the amount of blurring of the photographic subject image on the solid state image pickup device 5 in dt time amount, based on the information on the angular rate of rotation outputted from the above-mentioned integrators 23 and 24, and the focal distance outputted from focal distance detection equipment 25. In addition, the above-mentioned dt time amount shows time amount until reading appearance of the image data which received light in the photo detector section on a solid state image pickup device 5 (not shown) is carried out to the image memory of the image composition circuit 6.
[0092] Here, it is the focal distance f0 of the arbitration of theta x, thetay, and optical system 2 in the focal distance of the detected optical system 2, respectively about the angular rate of rotation of f, X shaft orientations, and Y shaft orientations. If the variation rate of the photographic subject image on the solid state image pickup device 5 generated in the unit angular rate of rotation of the image pick-up equipment which can be set is set to k, it will blur by the following operations and an amount (dx, dy) will be detected.
[0093] With dx=k-f/f0, thetax-dtdy=k-f/f0 and thetay-dt, in addition this operation gestalt, as amount detection of blurring of image pick-up equipment, although the X-axis angle-of-rotation acceleration sensor 21 and the Y-axis angle-of-rotation acceleration sensor 22 are used, angular-velocity sensors, such as for example, a gyroscope star (Murata Manufacturing make), may be used for instead of [those]. In this case, though natural, integrators 23 and 24 become unnecessary.
[0094] Since according to the above-mentioned configuration the amount operation part 26 of blurring blurs and an amount is calculated based on the output (X-axis angle-of-rotation acceleration, Y-axis angle-of-rotation acceleration) from the X-axis angle-of-rotation acceleration sensor 21 and the Y-axis angle-of-rotation acceleration sensor 22 or the output (angular rate of rotation) from an angular-velocity sensor, and the output (focal distance) from focal distance detection equipment 25, according to the focal distance of optical system 2, the amount of blurring on a solid state image pickup device 5 is always appropriately detectable.
[0095] When the speed of response of the X-axis angle-of-rotation acceleration sensor 21 and the Y-axis angle-of-rotation acceleration sensor 22 or the operation speed of integrators 23 and 24 is slow, it blurs on real time and it becomes impossible in addition, to detect an amount in such amount detection of blurring. In such a case, what is necessary is to perform the above amount detection of blurring for every fixed period, and just to predict the amount of blurring after dt time amount from the amount of blurring of the obtained past. As a prediction process, or it carries out linear prediction of the time change of the amount of blurring, for example from the past amount of blurring, there is the approach of predicting from a high order function based on the above-mentioned change. In addition, since the band of the amount of blurring of image pick-up equipment is low enough compared with the frequency of the inverse number of the period which detects the above-mentioned amount of blurring, the above prediction of it is sufficiently attained.
[0096] According to the above-mentioned configuration, the output (X-axis angle-of-rotation acceleration, Y-axis angle-of-rotation acceleration) or the output from an angular-velocity sensor (angular rate of rotation) from the X-axis angle-of-rotation acceleration sensor 21 and the Y-axis angle-of-rotation acceleration sensor 22, Since the amount of blurring after predetermined time can be predicted based on the amount of blurring calculated from the output (focal distance) from focal distance detection equipment 25, even if delay arises in the speed of response and signal processing of a sensor, the optimal amount of blurring at the time of performing the amount operation of amendments is detectable.
[0097] Next, other examples of a configuration of the amount detection equipment 9 of blurring are shown in drawing 1212 . As shown in this drawing, this amount detection equipment 9 of blurring consists of an image memory 31 which memorizes image data A obtained from a solid state image pickup device 5, an image memory 32 which memorizes image data B obtained after dt time amount progress after the above-mentioned image data A is obtained, and the above-mentioned image memory

31 and the motion vector computing element 33 which calculates the motion vector between 32. That is, it will blur here and an amount will be calculated as an amount of motion vectors. In addition, as the operation approach of a motion vector, since the gradient method, the representation point matching method, the optical flow method, etc. are well-known, detailed explanation is omitted.
[0098] Moreover, the time difference of two images at the time of calculating a motion vector is not restricted to dt. You may make it calculate the amounts dx and dy of motion vectors in dt time amount by the operation shown below from amount dx'dyof motion vectors ' in time amount dt' of arbitration.
[0099] If dx=dx', dt/dt'dy=dy'anddt/dt', thus the amount detection equipment 9 of blurring are constituted, the amount of blurring of image pick-up equipment will be calculated as movement magnitude on the direct solid state image pickup device 5. Therefore, it is not necessary to use the special sensor which detects the focal distance of optical system 2, the angular rate of rotation or rotational speed of image pick-up equipment, etc. in this case. So, according to the above-mentioned configuration, low cost-ization of equipment can be attained. Moreover, since it becomes unnecessary to perform amendment of a focal distance etc., the time and effort is also reducible.
[0100] When the operation speed of the motion vector computing element 33 is slow, it becomes impossible in addition, to detect the amount of motion vectors of blurring, i.e., the amount, on real time in such amount detection of blurring. In such a case, what is necessary is to perform the above amount detection of blurring for every fixed period, and just to predict the amount of blurring after dt time amount from the amount of blurring of the obtained past. As a prediction process, or it carries out linear prediction of the time change of the amount of blurring, for example from the past amount of blurring, there is the approach of predicting from a high order function based on the above-mentioned change. In addition, since the band of the amount of blurring of image pick-up equipment is low enough compared with the frequency of the inverse number of the period which detects the above-mentioned amount of blurring, the above prediction of it is sufficiently attained.
[0101] Since the amount of blurring after predetermined time can be predicted based on the amount of motion vectors of blurring outputted from the motion vector computing element 33, i.e., the amount, according to the above-mentioned configuration, even if delay arises in signal processing, the optimal amount of blurring at the time of performing the amount operation of amendments is detectable.
[0102] Next, actuation of the image pick-up equipment in this operation gestalt is explained based on drawing 13 . In addition, with this operation gestalt, since it is completely the same as that of the gestalt 1 of operation except actuation of the amount detection equipment 9 of blurring, and the judgment circuit 10 of operation, it mainly blurs and actuation of amount detection equipment 9 and the judgment circuit 10 of operation is explained.
[0103] First, if the amount detection equipment 9 of blurring blurs and an amount (dx, dy) is detected (S31), the judgment circuit 10 of operation will judge whether the above-mentioned amount of blurring (dx, dy) is 1/5 or less [of the image shift amount (Xr, Yr) which the shift-amount generator 7 outputs].
[0104] Here, Xr=1/2Px, Yr=1/2Py, then the judgment circuit 10 of operation will judge after all whether the above-mentioned amount of blurring (dx, dy) is 1/10 or less [of the pixel pitches Px and Py] (S32).
[0105] When it is judged in S32 that either of the amounts of blurring (dx, dy) is larger than 1/10 of the pixel pitches Px and Py, the judgment circuit 10 of operation controls the image shift amount (Xr, Yr) which the shift-amount generator 7 generates not to perform an image shift as Xr=0 and Yr=0 (S33). At this time, the output value of the shift-amount generator 7 is held with a fixed value (Xr=0, Yr=0).
[0106] And the image composition circuit 6 interpolates based on the image data of one photographic subject image, and compounds a high resolution image (S34). In addition, since the technique which compounds a high resolution image with interpolation has the well-known cubic convolution and NIARESUTONEIBA method etc., detailed explanation is omitted.
[0107] On the other hand, when it is judged in S32 that either of the amounts of blurring (dx, dy) is 1/10 or less [of the pixel pitches Px and Py], the judgment circuit 10 of operation sets the image shift amount which the shift-amount generator 7 generates as Xr=1/2Px and Yr=1/2Py (S35), and performs an image shift as usual by the control circuit 8. And when the image composition circuit 6 compounds the image of two sheets as usual, the image of high resolution will be obtained (S36).

[0108] In addition, in S32, the reason for having set the comparison with the amount of blurring (dx, dy) to one fifth of image shift amounts (Xr, Yr) is as follows. That is, the image shift shift amount (Xr, Yr) which the shift-amount generator 7 generates was shifted from the original image shift amount (Xr, Yr) like (0.8Xr, 0.8Yr), and ..., the image shift was performed as usual, and the experiment which compares subjectively the image compounded in the image composition circuit 6 was conducted (0.9Xr, 0.9Yr).
[0109] Consequently, in fluctuation to **20% of an image shift amount (Xr, Yr), it turned out that the image of high resolution is obtained by the image shift action, and there is effectiveness of an image shift. Therefore, one fifth of image shift amounts (Xr, Yr) was selected as comparison criteria with the amount of blurring (dx, dy).
[0110] In addition, with this operation gestalt, one fifth of image shift amounts (Xr, Yr) was selected based on the above experiments, and this value is not applied to all the image shift technique. That is, the above-mentioned value is influenced with the image shift technique, a solid state image pickup device, etc. Therefore, it is better to conduct the same experiment as the above suitably according to the class of each image pick-up equipment, and to select the above values.
[0111] According to the above-mentioned configuration, even if image pick-up equipment vibrates by blurring etc., actuation of the image composition circuit 6 will be properly used with extent of the amount of blurring. Therefore, according to the above-mentioned configuration, according to the above-mentioned amount of blurring, a high resolution image can be obtained by choosing the optimal image-processing method according to the above-mentioned amount of blurring.
[0112] In addition, although actuation of an image shift and a halt are controlled by extent of the amount of blurring detected with the amount detection equipment 9 of blurring, you may make it operate the image composition circuit 6 with this operation gestalt, operating an image shift.
[0113] [Gestalt 6 of operation] It will be as follows if other one gestalt of operation of this invention is explained based on drawing 14 and drawing 15 . In addition, the image pick-up equipment in this operation gestalt constitutes the amount detection equipment 9 (refer to drawing 10) of blurring only from focal distance detection equipment 25 while having allotted optical-system 2' instead of the optical system 2 (refer to drawing 10) of the image pick-up equipment explained with the gestalt 5 of operation. In addition, the member number same about the member of explanation used with the gestalt 5 of operation and the member which has the same function is written in addition for convenience, and the explanation is omitted.
[0114] Drawing 14 shows the configuration of the outline of the image pick-up equipment in this operation gestalt. This image pick-up equipment is equipped with optical-system 2', the X-axis image shift device 3 (image shift device), the Y-axis image shift device 4 (image shift device), a solid state image pickup device 5, the image composition circuit 6 (image composition means), the shift-amount generator 7, a control circuit 8 (control means), focal distance detection equipment 25 (focal distance detection means), and the judgment circuit 10 (judgment means of operation) of operation. In addition, the alternate long and short dash line in this drawing shows the optical axis. In addition, this invention is not restricted, although a graphic display and its explanation are directly omitted about the members (for example, image processing system for acquiring the actuation circuit of a solid state image pickup device 5, and a video signal etc.) of others irrelevant to this invention in order to simplify explanation.
[0115] Optical-system 2' is constituted including the lens group for completing the incident light from a photographic subject 1 on a solid state image pickup device 5 etc., and has become the zoom type whose focal distance is adjustable.
[0116] Focal distance detection equipment 25 detects the focal distance of optical-system 2'. Therefore, although this focal distance detection equipment 25 may be constituted from BARIETA prepared in optical-system 2', or potentionmeter interlocked with the compensator, it is not restricted to this and just detects the focal distance of optical-system 2' as a result.
[0117] Moreover, the judgment circuit 10 of operation has the function which controls the shift-amount generator 7 and the image composition circuit 6 based on the focal distance which focal distance detection equipment 25 detected.
[0118] When it judges that the image composition circuit 6 is larger than a value predetermined

[circuit / 10 / above-mentioned / of operation / judgment / above-mentioned] in the above-mentioned focal distance in the case of this operation gestalt, while carrying out interpolation processing in the image picturized with the above-mentioned solid state image pickup device 5 and obtaining an image, when the above-mentioned judgment circuit 10 of operation judges that it is below the above-mentioned predetermined value in the above-mentioned focal distance, two or more images by which an image shift was carried out compound by the image processing.

[0119] Next, it will be as follows if actuation of the image pick-up equipment in this operation gestalt is explained based on drawing 15 . In addition, with this operation gestalt, since it is completely the same as that of the gestalt 5 of operation except actuation of the judgment circuit 10 of operation, the explanation is omitted, and actuation of the judgment circuit 10 of operation is mainly explained.

[0120] First, if focal distance detection equipment 25 detects the focal distance f of optical-system 2' (S41), the judgment circuit 10 of operation will judge whether the above-mentioned focal distance f is 10mm or less (S42).

[0121] When it is judged that the focal distance f is over 10mm in S42, the judgment circuit 10 of operation controls the image shift amount (Xr, Yr) which the shift-amount generator 7 generates not to perform an image shift as Xr=0 and Yr=0 (S43). At this time, the output value of the shift-amount generator 7 is held with a fixed value (Xr=0, Yr=0).

[0122] And the image composition circuit 6 interpolates based on the image data of one photographic subject image, and compounds a high resolution image (S44). In addition, since the technique which compounds a high resolution image with interpolation has the well-known cubic convolution and NIARESUTONEIBA method etc., detailed explanation is omitted.

[0123] On the other hand, when it is judged in S42 that a focal distance f is 10mm or less, the judgment circuit 10 of operation sets the image shift amount which the shift-amount generator 7 generates as Xr=1/2Px and Yr=1/2Py (S45), and an image shift as usual is performed by the control circuit 8. And when the image composition circuit 6 compounds the image of two sheets as usual, the image of high resolution will be obtained (S46).

[0124] In addition, in S42, the reason for having set comparison criteria with a focal distance f to 10mm is based on the following experiments.

[0125] First, the stock of the image pick-up equipment which has the above configurations is carried out like usual, a photographic subject 1 is picturized, the same image shift as usual is performed, and a high resolution image is obtained. Next, such actuation is performed for every focal distance of optical-system 2'. And the comparison with each obtained synthetic image and the synthetic image obtained by fixing the above-mentioned image pick-up equipment to a tripod etc. is performed. Consequently, when the focal distance of optical-system 2' was 10mm or less, it turned out that an image [high resolution / without the case where image pick-up equipment is fixed, and inferiority] is obtained. Therefore, with this operation gestalt, comparison criteria with the focal distance in an image shift action were set to 10mm.

[0126] In addition, with this operation gestalt, 10mm of comparison criteria with a focal distance was selected based on the above experiments, and this value is not applied to all the image shift technique. That is, the above-mentioned value is influenced with the image shift technique, a solid state image pickup device, etc. Therefore, it is better to conduct the same experiment as the above suitably according to the class of each image pick-up equipment, and to select the above values.

[0127] According to the above-mentioned configuration, even if image pick-up equipment vibrates by blurring etc., actuation of the image composition circuit 6 will be properly used with the magnitude of the above-mentioned focal distance. Therefore, according to the above-mentioned configuration, a high resolution image can be obtained by choosing the optimal image-processing method according to the above-mentioned focal distance.

[0128]

[Effect of the Invention] The image pick-up equipment concerning invention of claim 1 the photographic subject image which carries out incidence through optical system as mentioned above The image shift device in which are image pick-up equipment picturized with the solid state image pickup

device which has two or more pixels arranged in the shape of a matrix, and the relative shift of the above-mentioned photographic subject image is carried out two-dimensional to the above-mentioned solid state image pickup device, A shift-amount generating means to generate the image shift amount of the above-mentioned photographic subject image, The control means which controls actuation of the above-mentioned image shift device, and an image composition means to compound two or more images shifted by the above-mentioned image shift device, An amount detection means of blurring to detect the amount of blurring of equipment is established. The above-mentioned shift-amount generating means The 1st amendment image shift amount is generated based on the above-mentioned image shift amount and the above-mentioned amount of blurring, and the above-mentioned image shift device is the configuration to which a photographic subject image is shifted based on the above-mentioned 1st amendment image shift amount.

[0129] So, when the stock of the image pick-up equipment is carried out, for example, even if blurring arises in a photographic subject image, the image shift in consideration of the amount of blurring will be performed. Therefore, according to the above-mentioned configuration, even if blurring arises to equipment by a stock etc., the effectiveness that the image of high resolution which is not influenced by such blurring can be obtained is done so.

[0130] The image pick-up equipment start to invention of claim 2 is the configuration that the above-mentioned image composition means carries out an image processing based on the above-mentioned amount of amendments, in the above-mentioned shift-amount generating means in the configuration of claim 1 as mentioned above, while the above-mentioned 1st amendment image shift amount divides to the 2nd amendment image shift amount and the amount of amendments and the above-mentioned image shift device shifts a photographic subject image based on the above-mentioned 2nd amendment image shift amount by the predetermined operation.

[0131] So, since the above-mentioned image shift device makes a photographic subject image shifted based on the small above-mentioned 2nd amendment image shift amount of a shift amount rather than the above-mentioned 1st amendment image shift amount in addition to the effectiveness by the configuration of claim 1, a response becomes fully possible also by the small image shift device, and the image shift itself is performed promptly. Therefore, according to the above-mentioned configuration, while being able to attain the miniaturization of an image shift device, the effectiveness that improvement in the speed of an image shift can be attained is done so.

[0132] In the configuration of claim 2, the above-mentioned 2nd amendment image shift amount of the image pick-up equipment concerning invention of claim 3 is the fraction part of the above-mentioned 1st amendment image shift amount as mentioned above, and the above-mentioned amount of amendments is a configuration which is the integer part of the above-mentioned 1st amendment image shift amount.

[0133] So, since the range of an image shift becomes below a 1-pixel pitch and becomes narrower than the beginning, a response becomes fully possible also by the small image shift device, and the image shift itself is performed promptly. Therefore, according to the above-mentioned configuration, while being able to attain the miniaturization of an image shift device, the effectiveness that improvement in the speed of an image shift can be attained is done so.

[0134] The image pick-up equipment concerning invention of claim 4 is a difference with the amount in which the above-mentioned 2nd amendment image shift amount revalued the fraction part of the above-mentioned 1st amendment image shift amount and the above-mentioned 1st amendment image shift amount in the configuration of claim 2 as mentioned above, and the above-mentioned amount of amendments is the configuration which is the amount revalued in the fraction part of the above-mentioned 1st amendment image shift amount.

[0135] So, since the range of an image shift becomes below a 1-pixel pitch and becomes narrower than the beginning, a response becomes fully possible also by the small image shift device, and the image shift itself is performed promptly. Therefore, according to the above-mentioned configuration, while being able to attain the miniaturization of an image shift device, the effectiveness that improvement in the speed of an image shift can be attained is done so.

[0136] The image pick-up equipment concerning invention of claim 5 is a difference with the integer

part of the amount to which the above-mentioned 2nd amendment image shift amount added 0.5 to the above-mentioned 1st amendment image shift amount and the above-mentioned 1st amendment image shift amount in the configuration of claim 2 as mentioned above, and the above-mentioned amount of amendments is the configuration which is the integer part of the amount added in 0.5 to the above-mentioned 1st amendment image shift amount.

[0137] So, since the amount which carries out an image shift according to the above-mentioned image shift device, i.e., the 2nd amendment image shift amount, becomes below a **0.5-pixel pitch, there is little absolute magnitude of the variation rate by image shift, and it comes to end. Therefore, according to the above-mentioned configuration, while being able to attain the further miniaturization of an image shift device, the effectiveness that further improvement in the speed of an image shift can be attained is done so.

[0138] The image pick-up equipment concerning invention of claim 6 the photographic subject image which carries out incidence through optical system as mentioned above The image shift device in which are image pick-up equipment picturized with the solid state image pickup device which has two or more pixels arranged in the shape of a matrix, and only a predetermined shift amount carries out the relative shift of the above-mentioned photographic subject image two-dimensional to the above-mentioned solid state image pickup device, The control means which controls actuation of the above-mentioned image shift device, and an amount detection means of blurring to detect the amount of blurring of equipment, A judgment means of operation to judge actuation of whether for the above-mentioned amount of blurring to be compared with a predetermined value, and to perform an image shift, When the above-mentioned judgment means of operation judges that it is larger than a value predetermined [above-mentioned] in the above-mentioned amount of blurring While carrying out interpolation processing of the image picturized with the above-mentioned solid state image pickup device and obtaining an image, when the above-mentioned judgment means of operation judges that it is below a value predetermined [above-mentioned] in the above-mentioned amount of blurring It is the configuration that an image composition means to compound two or more images shifted by the above-mentioned image shift device by the image processing is established.

[0139] So, the effectiveness that a high resolution image can be obtained with extent of the above-mentioned amount of blurring according to the above-mentioned amount of blurring by choosing the optimal image-processing method according to the above-mentioned amount of blurring since the image-processing approach of an image composition means is used properly is done.

[0140] The image pick-up equipment concerning invention of claim 7 the photographic subject image in which a focal distance carries out incidence as mentioned above through the optical system which is adjustable The image shift device in which are image pick-up equipment picturized with the solid state image pickup device which has two or more pixels arranged in the shape of a matrix, and only a predetermined shift amount carries out the relative shift of the above-mentioned photographic subject image two-dimensional to the above-mentioned solid state image pickup device, The control means which controls actuation of the above-mentioned image shift device, and a focal distance detection means to detect the focal distance of the above-mentioned optical system, A judgment means of operation to judge actuation of whether for the above-mentioned focal distance to be compared with a predetermined value, and to perform an image shift, When the above-mentioned judgment means of operation judges that it is larger than a value predetermined [above-mentioned] in the above-mentioned focal distance While carrying out interpolation processing of the image picturized with the above-mentioned solid state image pickup device and obtaining an image, when the above-mentioned judgment means of operation judges that it is below a value predetermined [above-mentioned] in the above-mentioned focal distance It is the configuration that an image composition means to compound two or more images shifted by the above-mentioned image shift device by the image processing is established.

[0141] So, the effectiveness that a high resolution image can be obtained with the magnitude of the above-mentioned focal distance according to extent of the above-mentioned focal distance by choosing the optimal image-processing method according to extent of the above-mentioned focal distance since

the image-processing approach of an image composition means is used properly is done.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view showing the example of 1 configuration of the image pick-up equipment concerning this invention.
[Drawing 2] (a) is a timing chart which shows the timing which an image location shifts, and (b) is a timing chart which shows the timing to which the image memory of an image composition circuit incorporates image data from a solid state image pickup device.
[Drawing 3] It is the explanatory view showing signs that the image has blurred on the solid state image pickup device.
[Drawing 4] It is the explanatory view showing arrangement of two image data on a solid state image pickup device when blurring arises to equipment.
[Drawing 5] It is the flow chart which shows the flow of the actuation in a shift-amount generator.
[Drawing 6] (a) is the explanatory view showing arrangement of the image data before amendment, and (b) is the explanatory view showing arrangement of the image data after amendment.
[Drawing 7] It is the explanatory view showing the condition of having compounded two image data.
[Drawing 8] It is the flow chart which shows the flow of other actuation in the above-mentioned shift-amount generator.
[Drawing 9] It is the flow chart in the above-mentioned shift-amount generator which shows the flow of other actuation further.
[Drawing 10] It is the explanatory view showing other examples of a configuration of the above-mentioned image pick-up equipment.
[Drawing 11] It is the block diagram showing the example of 1 configuration of the amount detection equipment of blurring.
[Drawing 12] It is the block diagram showing other examples of a configuration of the above-mentioned amount detection equipment of blurring.
[Drawing 13] It is the flow chart which shows the flow of the actuation in the judgment circuit of operation established in the above-mentioned image pick-up equipment.
[Drawing 14] It is the explanatory view showing the configuration of further others of the above-mentioned image pick-up equipment.
[Drawing 15] It is the flow chart which shows the flow of the actuation in the judgment circuit of operation established in the above-mentioned image pick-up equipment.
[Drawing 16] It is a sectional view showing the principle of an image shift.
[Drawing 17] It is the perspective view showing the example of 1 configuration of conventional image pick-up equipment.
[Drawing 18] (a) is the explanatory view showing the image data of Image A, and (b) is the explanatory view showing the image data of Image B.
[Drawing 19] It is the explanatory view showing the image shift amount of the two above-mentioned image data.
[Drawing 20] It is the explanatory view showing the condition of having compounded the two above-

mentioned image data.
[Description of Notations]
1 Photographic Subject
2 Optical System
2' Optical system
3 X-axis Image Shift Device (Image Shift Device)
4 Y-axis Image Shift Device (Image Shift Device)
5 Solid State Image Pickup Device
6 Image Composition Circuit (Image Composition Means)
7 Shift-Amount Generator (Shift-Amount Generating Means)
8 Control Circuit (Control Means)
9 The Amount Detection Equipment of Blurring (the Amount Detection Means of Blurring)
10 Judgment Circuit of Operation (Judgment Means of Operation)
25 Focal Distance Detection Equipment (Focal Distance Detection Means)

[Translation done.]

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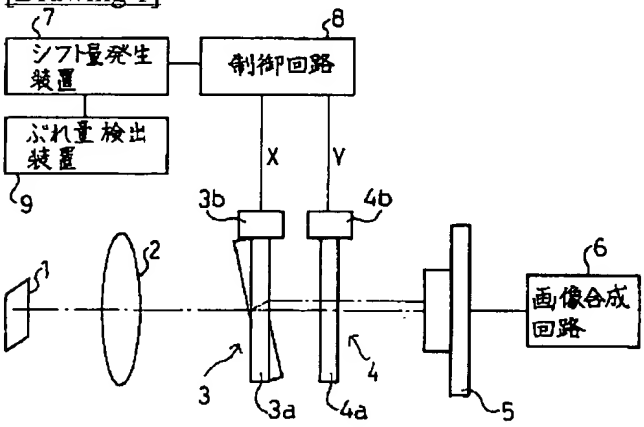
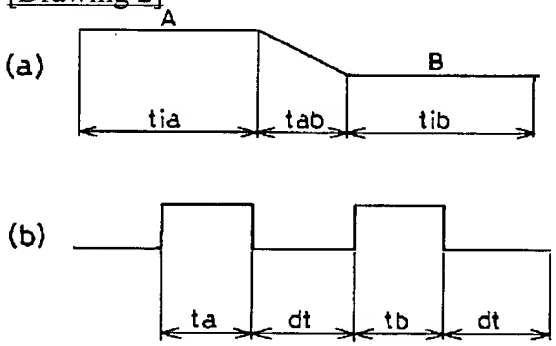
DRAWINGS

[Drawing 1]



[Drawing 2]



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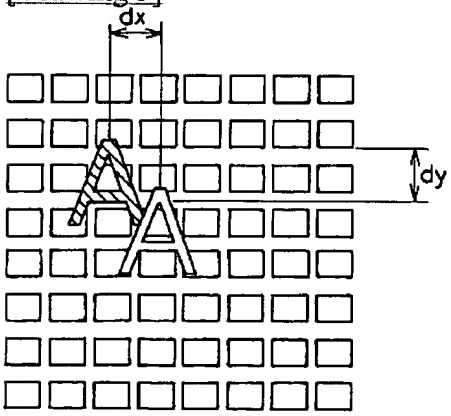

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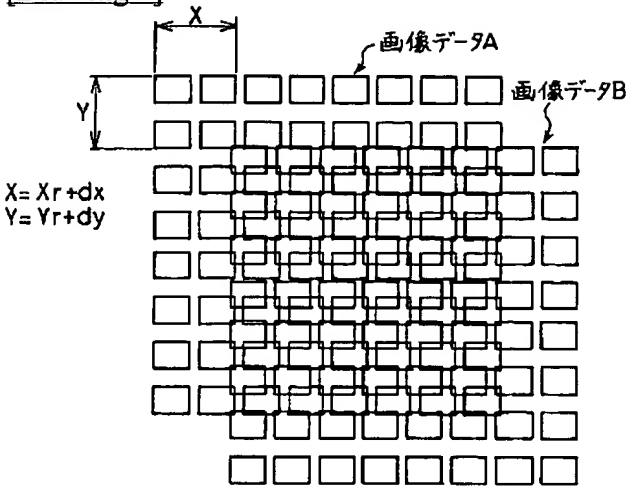

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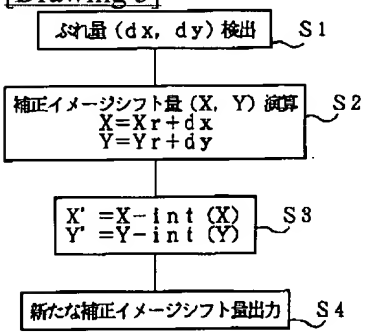

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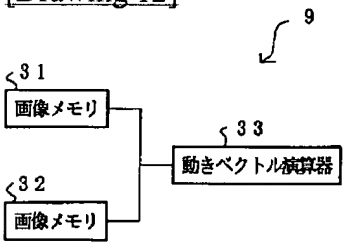

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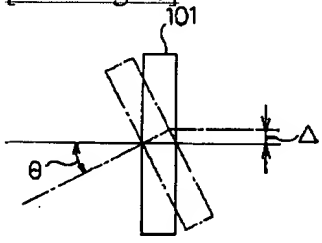

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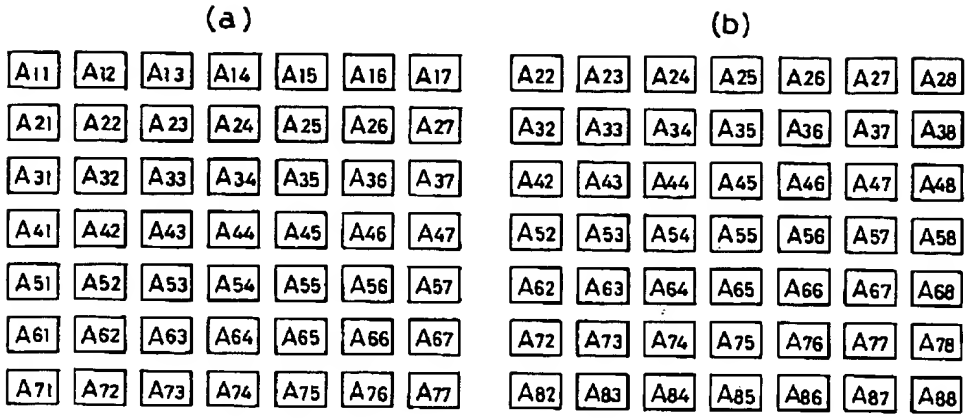

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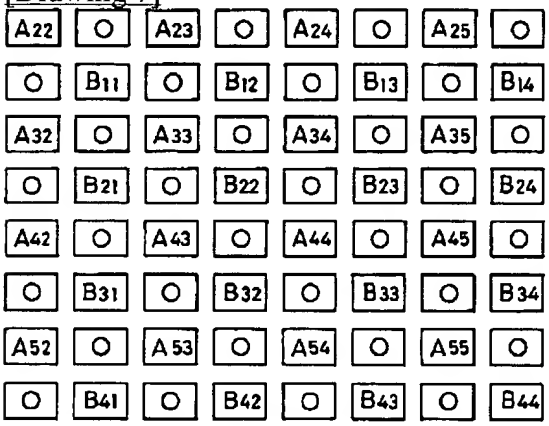

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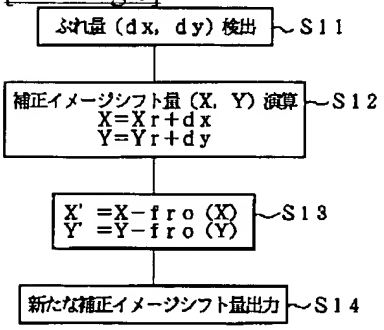
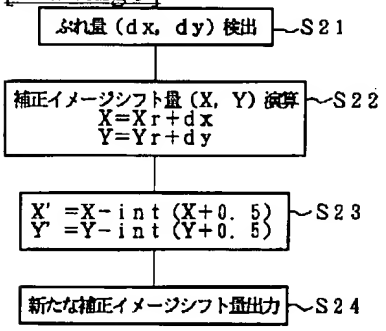


[Drawing 9]



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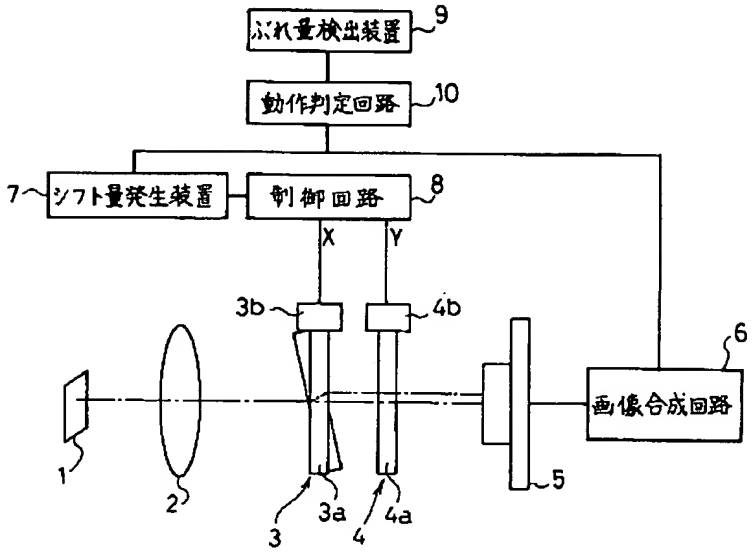

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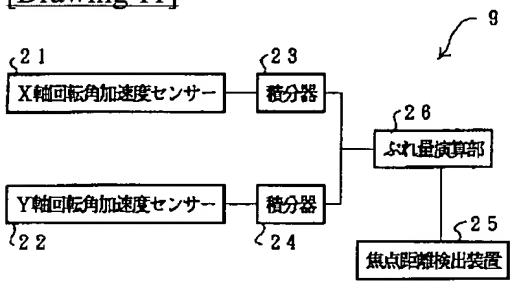

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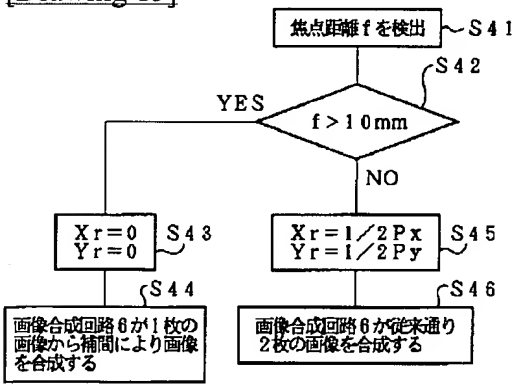

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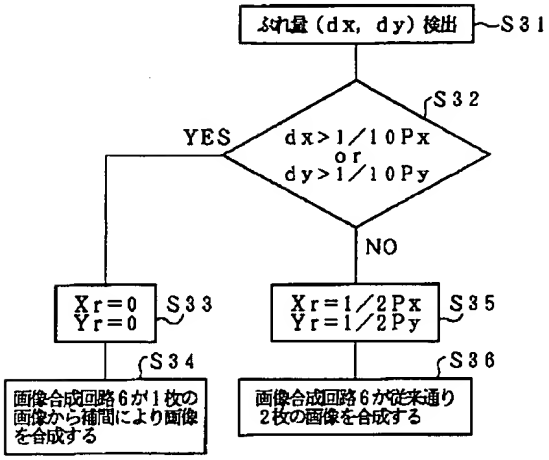

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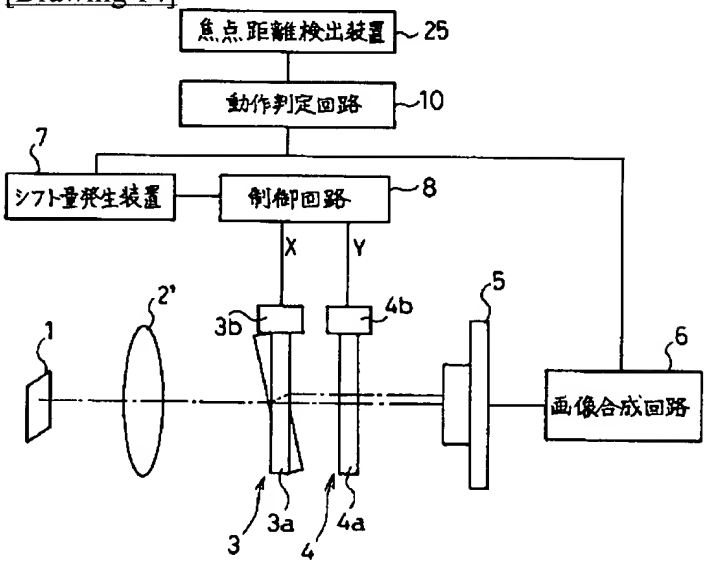
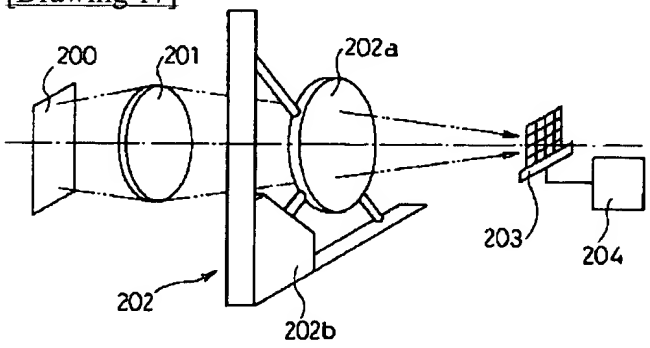


[Drawing 17]



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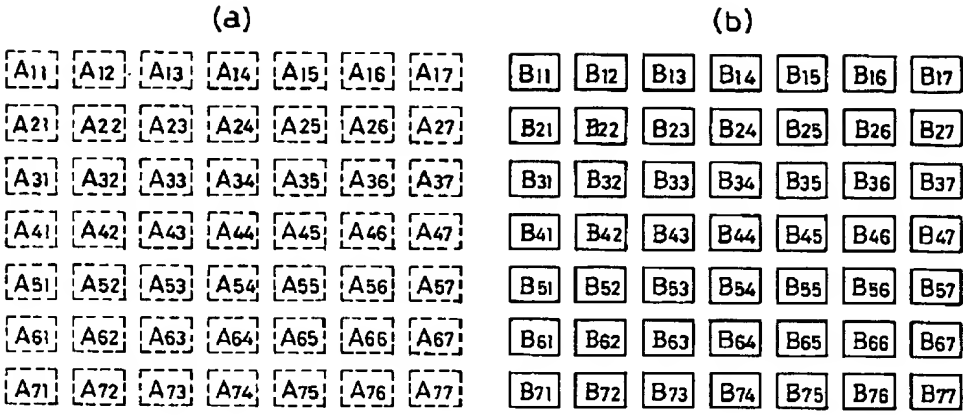
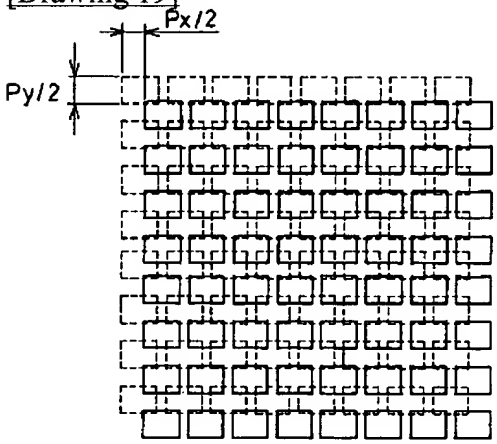


[Drawing 19]



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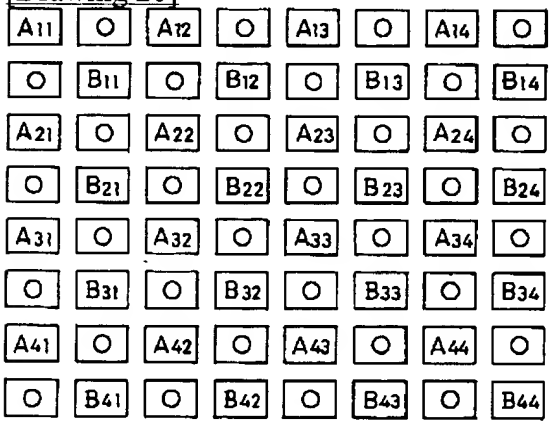

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